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(19)(CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Credit Risk Assessment System

(72) Willis, Michael - Canada ;

(73) Same as inventor

(57) 4 Claims (NO DIAGRAMS)

Canada

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Section 0: Abstract

The system allows the user to gauge the likelihood of loan default across an entire economy or within a portion of an economy such as a region or an industry.

The core of the system is a methodology for forecasting bankruptcy rates[1]. Via the methodology described in this document, it is possible to forecast bankruptcy rates 5 or more quarters hence.

Knowledge of future bankruptcy rates would allow a creditor to make profitable adjustments in its loan granting, loan monitoring and loan collection practices.

The canadian version of the product is ready for sale. US and UK versions are in progress and versions for other industrialized countries are planned. Eventually, the set of country-systems will constitute a super-system usable for the purpose of global credit-risk management.

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[1] Throughout this document the term "bankruptcy" will be used to describe the case of either de jure bankruptcy or the pre-bankruptcy period of restructuring permitted under the June, 1992 revision to canadian bankruptcy legislation. In either of these circumstances, the creditor is at considerable risk.

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Section 1: Our Invention within the Intellectual Property Framework

In this brief, preliminary section we explain why we seek protection via patent, in particular. Part of the explanation deals with the inherent nature of our system and part deals with a certain kinship between our system and others which have been granted patents.

1.1: Patent as the Most Suitable Form of Intellectual Property Protection for the System

Consider the key quotation from page 7 of the Guide to Patents;

> A patent is granted only for the physical embodiment
> **of an idea....or for a process that produces something
> saleable or tangible.** You cannot patent a scientific
> principle, an abstract theorem, an idea, a method of
> doing business, a computer program, or a medical
> treatment.

The phrase in bold describes our invention; "a process that produces something saleable".

The salability of the process embodied in our invention is obvious but is, in any case, discussed explicitly in Section 2.4.8. "The System As a Product".

As important is what our system is not. If the system were a "computer program"/software, copyright law would apply. But the system does not entail any fixed inputs with fixed associated outputs linked by programming in a computer language. The system is much more flexible than computer software and, thus, can accommodate many variants of the basic specification outlined here. Section 2.4.3., "The Variables Used to Generate Forecasts", as well as Section 2.4.10, "Alternative Specifications of the System" illustrate this point.

Secondly, the system's obvious commercial applicability differentiates it from any "abstract theorem".

Furthermore, though a number of original (semi-scientific)

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principles and ideas underlie the system (eg. Section 2.3, "The Inventive Idea and How It Overcomes Difficulties with Existing Methods"), Section 2.4.8, "The System As a Product", deals with the application of these principles to the practical business of credit risk assessment.

Finally, our system is much too technical, narrow and objectively-testable to be considered a "method of doing business". Our system possesses much more the tenor of, say, a manufacturing quality-control system than "Total Quality Management". Much of the material in this document, especially Exhibit 2, "Test Forecasts", emphasizes this point.

A further means of establishing patentability is to cite a number of patented inventions and to compare them with ours along certain relevant dimensions.

1.2. The System in Light of Existing Patents

We conducted a thorough search of canadian patents. The search uncovered no patents (or patents pending) which would create doubt as to the originality of our system. However, we have identified a number of patented inventions (ie. patents granted, not merely pending) which possess broad attributes reminiscent of certain features of our system;

1. Canadian Patent #; 1 301 333; "Credit Check Scanner Data Analysis System"

. The system addresses the measurement of Credit Risk (ie. the worthiness of a customer to have his/her cheque guaranteed)

. Use of the system requires economic (and demographic) data as well as a computer; However, several versions of the system proposed would be effective. Thus, the system is not "software", but is more general than any specific software package.

. The invention entails a 'system' only; No 'device' has been invented.

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2. Canadian Patent #; 1 280 213; "Default Proof Credit Card
                                   System"

. The system addresses the measurement of Credit Risk (ie. "...a
novel system for determining the line of credit for credit card
users based on their life insurance policies' cash flows")

. The invention entails a 'system' only; No 'device' has been
invented.

3. Canadian Patent #;   990 407; "Method of Determining Yield
                                   Loss Due to a Combination of
                                   Defects in Manufactured Units and
                                   Manufacturing Method Utilizing
                                   Same"

. Statistical methods are employed in order to reduce the rate of
defects in manufacturing; Our purpose is to use statistical
methods to reduce the rate of loan loss to banks. The broad
conceptual similarity is obvious.

. The invention entails a 'system' only; No 'device' has been
invented.

Each of these three patented inventions is purely a 'system'
rather than a 'device'. Obviously, this is true of our invention
as well. It may be that such inventions (at least, ours and the
first two above) reflect a slight shift over the last 25 years
from inventions applicable in manufacturing to inventions
applicable in the services sector.

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Section 2: Specification of the System

The discussion in this lengthy section follows the format
suggested in the Guide to Patents.

2.1 General Character of the Process

The system would allow a creditor to assess accurately the
movements in consumer bankruptcy rates and business bankruptcy
rates between the point of forecast and 5-quarters hence. (If
desired, forecasts could be made 6, 7 or 8 quarters ahead.)
Expansionary, contractionary or stable positions could then be
adopted for the lender's credit-granting strategy.

The foundation for the development of explanatory variables is
the proposition that a region, industry or entire economy can be
assessed in terms of credit risk in much the same way as can an
individual borrower. Specifically, a region, industry or entire
economy can be said to possess an "economic condition", a level
of "debt burden", and a "credit history". Each of these three
concepts is operationalized through a specific explanatory
variable.

Forecasts can be generated by Real Economics Inc. for each of the
ten canadian provinces, for each of seven industrial sectors
(Primary, Manufacturing, Construction, Transportation &
Communication, Trade, Finance, and Services) or for any of the 10
x 7 = 70 province/sector combinations (eg. Alberta Construction).
(In fact, though, the most effective system seems to be one in
which; a. the four Atlantic provinces are not addressed
individually, but are combined into one Maritime region, and b.
Primary Industries and Finance are excluded from the analysis of
business bankruptcies. Thus, the sectors under consideration
include only the five standard categories of "Consumer &
Industrial Loans": Manufacturing, Construction, Transportation &
Communication, Trade and Services.)

In the case of smaller combinations, the number of bankruptcies
may be rather small, thus limiting the effectiveness of

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statistical methods. As important, is the fact that there is surprisingly little difference in the patterns exhibited by bankruptcy rate movements across provinces, even across sectors. These facts, together, lead to the following recommendation by Real Economics Inc.;

The best use of the system is to generate quarterly two broad forecasts -- the change in consumer bankruptcy rate over the next five quarters, and the change in the business bankruptcy rate over the next five quarters. The technique for approaching this task is to generate not only these two forecasts themselves, but a number of highly-related forecasts which can be combined to form a set of semi-distinct forecasts of essentially the same phenomenon. In forecasting the change in consumer bankruptcy rate for Canada, for example, we calculate this forecast of course, but also the forecast for each region of Canada. Also, we forecast the 6-quarter change in canadian consumer bankruptcy rate using numbers from one-quarter ago and the 7 and 8-quarter forecasts using numbers from two and three quarters ago, respectively. Thus, though we might seek only the 5-quarter forecast for Canada, we have a large number of individual forecasts which are somewhat distinct but which, inevitably, show a definite pattern.

There are three reasons for generating such a set of forecasts; a. A set of forecasts possessed of a definite pattern is more likely to influence the strategy of a creditor than is one number, however strong the alleged explanatory power of the forecast model. b. There is one province (British Columbia) and one sector (Construction) whose bankruptcy rates do not follow the economy-wide rate as closely as the others. One might wish to generate a separate forecast for each of these. c. Each forecast possesses some error. The various forecasts have somewhat different associated errors. Furthermore, the errors corresponding to each forecast are somewhat independent and, thus, appear to offset each other to some extent. In this sense, the set of forecasts aimed at predicting, say, the change in the canadian consumer bankruptcy rate is more reliable than any single forecast.

The statistical properties of our forecast models are attractive and imply a high degree of explanatory power. Furthermore, in this patent application we include a number of "test forecasts" in which we 'forecast' known bankruptcy rates using only data

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which would have been available at the time of the forecast.
These results demonstrate clearly the effectiveness of the
system.

Our primary objective is to sell the system to creditors. In
Section 2.4.8, we describe the means through which Real
Economics, Inc. intends to transfer its forecasting capability to
customers. There are, as well, certain theoretical implications
of our work which we explore briefly in Section 4.

2.2 The Nature of Processes Previously Used and Associated Difficulties

There are three types of activity with which the Real Economics
Inc. system may be compared;

2.2.1 Credit Analysis on a Borrower-Specific Basis

Scrutiny of borrower or potential-borrower characteristics such
as "Character", "Collateral" etc. has constituted the essence of
credit decision-making for hundreds of years. Recently, automated
credit-scoring systems have become popular with credit bureaux
and with creditors of all kinds, particularly in decisions
concerning consumer credit. Nevertheless, borrower-specific
analysis (whether by a loan officer or by a computer algorithm)
governs the credit-granting process.

Real Economics Inc. has no ambition to supplant this tradition.
The lending business has been quite successful much of the time
through applying its established techniques. Furthermore, whether
future bankruptcy rates are to be high or low, certain borrowers
are riskier than others; Attention to these individual
differences should not diminish at all.

It remains true, however, that Real Economics Inc. can provide
further information which would enable a creditor better to
understand the risk which it faces. It is true also, that lenders
always have sought to expand or to contract their aggregate
lending activities according to perceived market conditions. The
Real Economics Inc. system merely provides a more scientific
methodology through which creditors can make such aggregate

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credit-granting decisions.

Don't creditors already have reliable information concerning credit market conditions and the consequent aggregate risk to which they are subject? In fact, creditors routinely absorb enormous losses through failure to anticipate increases in bankruptcy rates and, more subtly, forego great gains through failure to anticipate declines in bankruptcy rates.

How does the Real Economics Inc. system create new information? Shouldn't the relevant macro conditions be reflected in the circumstances of individual credit-applicants? One answer is that the applicant for a loan often has both the motive and the opportunity to withhold inflammatory information concerning his/her credit worthiness. The statistics employed in the Real Economics Inc. system, on the other hand, originate from an objective source. This key point is elaborated in section 2.3.7.

2.2.2 Attempts to Forecast General Economic Conditions

Many economists in government, academia, commerce and finance attempt to forecast general economic conditions as represented, for example, by the pattern of Gross Domestic Product. Such forecasting is difficult due to the complexity of an economic system and due to the dependence of GDP on public policy intervention both domestically and abroad. Nevertheless, substantial advances have been made and modern forecasters generally succeed in beating prediction by coin-toss or prediction by the less sophisticated techniques of twenty or thirty years ago.

The problem is not the ability of forecasters, but what they choose to forecast. The presumption within the financial community is that bankruptcy rates merely are an element of general economic conditions -- that bankruptcy rates move up and down with, say, GDP. Thus, the task of forecasting bankruptcy rates (if that task actually were undertaken explicitly) would be treated as subsumed by the task of forecasting general economic condition.

Further on in this application it is shown, not only that the two types of forecasting are entirely distinct, but that forecasting

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bankruptcy rates can be much easier than forecasting general economic conditions.

2.2.3 Statistical Analyses of Business Bankruptcy Rates in Academia

Our search of the Business Periodicals Index has yielded four citations related to the statistical analysis of bankruptcy rates.[2] Bankruptcies obviously are an important economic (and legal) phenomenon; Thus, it is somewhat of a surprise that there has been so little analysis of bankruptcy rates by scholars in economics departments or in business schools. Nevertheless, it is incumbent upon Real Economics Inc. to demonstrate that published work does not contain the key elements of the system for which we seek a patent.

Firstly, in none of the existing work on the subject did the author(s) have the objective of creating a tool usable by creditors for the task of managing their loan portfolio. Bankruptcy Rates are, rather, treated merely as a general

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[2] These four publications are;

1. Altman, E. I., 1971, Corporate Bankruptcy in America. Lexington, Mass: Heath-Lexington Books.

2. Altman, E. I., 1974, "Predicting Railroad Bankruptcies in America", Bell Journal of Economics and Management Science 5(1):184-211.

3. Rose, P. S., Andrews, W. T., and Giroux, G. A., Fall 1982, "Predicting Business Failure: A Macroeconomic Perspective", Journal of Accounting, Auditing and Finance 6(1):20-31.

4. Melicher, R., Hearth, D., 1988, "A Time Series Analysis of Aggregate Business Failure Activity and Credit Conditions", Journal of Economics and Business 40:319-333.

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economic phenomenon and not as an event which entails loss to creditors in particular. This is corroborated by the fact that the authors do not distinguish between bankruptcy (in which creditors lose) and "business failure" in general which might include voluntary dissolution of businesses not in debt. Although the data which they use in empirical tests tends to deal with bankruptcies, the conceptual portions of the authors' work reflects little interest in the distinction between bankruptcy and "failure" by other means.

Each of the authors employs explanatory variables (ie. variables meant to 'explain' bankruptcy rates) one or more of which are cotemporaneous with the bankruptcy rate in question and/or which are lagged by only one quarter. Clearly, any relationship between bankruptcy rates and X which exists at a lag of one-quarter or less could not be used by a creditor for the purposes of loan portfolio management. This is even more obviously true when one considers that the relevant data on X is available with a lag of between one and three months. Thus, it must not have been the intention of the authors that their work be used for the purpose of credit risk management.

The Real Economics Inc. system employs variables which entail at minimum a lag of _five-quarters_. Such a lag renders the models usable for strategic planning and, paradoxically, _dramatically_ increases the explanatory power of the models.

Secondly, existing work deals exclusively with business bankruptcies (or "business failures") rather than with consumer bankruptcies. Patterns in consumer bankruptcies have been discussed in the popular literature, but the application of statistical analysis in published work apparently has dealt exclusively with the business side.

It is the consumer half of the Real Economics Inc. system which is featured here and which will be emphasized in actual marketing. Personal bankruptcies represent credit risk better than business bankruptcies do. As argued again below, this follows from the fact that the magnitude of liabilities within debtor businesses varies far more than does that for individuals. Thus, the total loss of business lenders is related to business bankruptcy rates less tightly than is the total loss of consumer

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creditors to consumer bankruptcy rates.

Again, statistical analysis of consumer bankruptcy rates (in general, let alone for the purpose of aggregate credit risk assessment) appears to be absent from the literature.

Finally, one must wonder why there has been so little systematic work on the subject of bankruptcy rates. We believe that there are several elements in the explanation; a. little recognition of the fact that future movements in bankruptcy rates do provide a fair measure of aggregate credit risk, b. the mistaken presumption that the forecast of bankruptcy rates is subsumed by the attempt to forecast general economic condition, and c. the tendency to understate greatly the lag between explanatory variables and bankruptcy rates which provides the best forecasting power. This latter point has caused existing work on the forecast of bankruptcy rates to yield sub-optimal results.

Of the four publications cited, Melicher & Hearth utilize fairly obscure statistics methodology which provides no over-all measure of explanatory power (such as "R-squared"). Rose et al. forecast bankruptcy rates rather than change in bankruptcy rates so that their R-squared values are artificially high; Bankruptcy rates are so highly serially-correlated that one can hardly fail to 'explain' a high proportion of bankruptcy rate movements if one uses the raw bankruptcy rate as the dependent variable and concurrent or one-quarter lag variables as regressors.[3] Only in the two pieces by Altman is the change in bankruptcy rate forecast with accompanying measures of explanatory power. His tests yield R-squared values of 0.19 and 0.26 respectively. Even if Altman's intention were that his work be used for credit risk management and even if he did employ sufficient lags to permit such use, explanatory power at the level of 19% or 26% likely would not convince creditors that the methodology was reliable.

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[3] Our own experiments with the use of raw bankruptcy rates (rather than changes in rates) generated huge R-Squared values (ie. 0.95), but only mediocre forecasting power.

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Our work, comparable to Altman's in its pursuit of the more useful task of forecasting change in bankruptcy rates, generates R-squared values of greater than 0.8 for change in consumer bankruptcy rates and greater than 0.7 for change in business bankruptcy rates. The irony is that when we employ the same regressors which are successful at a lag of 5-quarters or more to concurrence or a one-quarter lag, we get much poorer results.

2.3 The Inventive Idea and How It Overcomes Difficulties with Existing Methods

Eight mental steps were involved in the development of this innovation; (Some have been mentioned already; All are developed more fully later on.)

2.3.1. We noticed that bad loans come in bunches. That is, regardless of the characteristics of specific borrowers, loan losses are relatively high at certain times and relatively low at other times. It seemed, thus, that borrowers in general are subject to a common set of forces which affect, in aggregate, their probability of default.

2.3.2. We noticed that bankruptcy rates serve as a good proxy for the more abstract notion of aggregate credit risk.[4] Though it is possible for a borrower to default without declaring bankruptcy, the latter is the most usual means of loan loss to a creditor.

Consider the following passage from Commercial Bank Financial Management (J. Sinkey, MacMillan publishing, 1992). (This is the text used in the course "Bank Management" at the Wharton School

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[4] We note again that the three authors cited above who have applied statistical techniques to the analysis of bankruptcy rates treat the latter merely as an economic indicator. There is no attempt in their work to generate a viable system for the management of credit risk.

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of Finance.);

> In 1990, an estimated 735,000 debtors filed for
> personal bankruptcy...if lenders can identify
> potential bankrupts, they can avoid making loans
> to those borrowers, or, if they are existing
> borrowers, close or reduce the credit limit on
> their accounts.

It appears that the probability of personal bankruptcy inherently
is a better representation of personal credit risk than is the
probability of business bankruptcy in the case of business credit
risk. This simply is because the value of liabilities in bankrupt
businesses varies much more than that of bankrupt individuals.
One Olympia & York disaster, for example, can negate the effect
of an otherwise moderate business bankruptcy rate across the
economy. For this reason, the half of our system which deals with
consumer bankruptcies will be featured somewhat more than its
business bankruptcy counterpart.

2.3.3. We noticed that the few researchers who have analyzed
movements in bankruptcy rates have presumed that bankruptcy rates
simply move with general economic conditions in the obvious way;
that is, high rates during recession and lower rates during
expansion.

In fact, this is not true; the relationship between bankruptcy
rates and other economic phenomena is complex and surprising, as
the analysis by Real Economics Inc. demonstrates.

2.3.4. We noticed that movements in bankruptcy rates show a
remarkably smooth pattern over time. When an economic time series
moves in such a fashion, one must wonder whether there is some
set of identifiable 'fundamentals' which is driving the pattern.

2.3.5. We recognized that the decision to declare bankruptcy,

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either for an individual or for a business, is monumental. It represents a perception that there is no viable alternative. One must reckon, therefore, that such a decision is not taken hastily and, thus, that bankruptcy rates likely represent a _delayed reaction_ to other economic phenomena. Bankruptcy rate movements, it was hypothesized, might follow other events with a lag of a year or more.

The presence of such a lag obviously is critical to the viability of this innovation as a product; Bankruptcies are rendered predictable and with a forecast horizon which is long enough that creditors can react appropriately.

2.3.6. We suspected that aggregations of borrowers can be described as creditors typically describe individual borrowers; Specifically, a region, industry or entire economy is said to possess an "economic condition", a level of "debt burden" and a "credit history". From each of these three broad characteristics, a specific variable is derived which is employed in quantitative forecasts of bankruptcy rates.

2.3.7. We reasoned that the information used by Real Economics Inc. to implement its system is more objective and more complete than that received by a Loan Officer in dealing with an individual applicant for credit. The applicant may withhold information relevant to the credit decision if such information reduces his/her apparent credit-worthiness. Despite the best efforts of credit bureaux, this "information asymmetry" is endemic to the creditor-borrower relationship. Consider Sinkey's statement of the problem (_Commercial Bank Financial Management_, p.516);

> For lenders, agency problems arise from hidden action or hidden information or both. Specifically, borrowers know more about their financial condition than lenders. Since lenders as outsiders lack inside information and cannot continuously monitor the actions of borrowers, they are at a disadvantage vis-a-vis insiders. A borrower's dishonesty, lack of effort, or failure

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to supply timely and accurate information creates
the disadvantage.

The system proposed by Real Economics Inc. requires no
information from individual borrowers. All data is issued by
Statistics Canada. The latter has no motive (or tendency) to
manipulate its data and does not publish the data specifically
for the use to which it is put by Real Economics Inc.

The difference in the accuracy of information between borrower-
specific credit analysis and aggregate analysis is one of the key
sources of value-added in the Real Economics Inc. system.

2.3.8. We note briefly here that the application of this
methodology to the task of credit risk management is both
effective and inexpensive. The latter attribute is especially
evident when one compares the Real Economics Inc. system with the
enormous apparatus associated with credit decisions made on a
borrower-by-borrower basis.

2.3.9. We realized that each of the major industrialized
countries maintains a database of national/regional/industrial
statistics which would promote the development of analogous
versions of this system. Such a set of systems would constitute a
super-system usable for the management of a global loan
portfolio.

2.4 Full Description of Operationalizing the Inventive Idea

2.4.1. The Overall Objective

The system enables the creditor to generate quarterly forecasts
for the change in consumer bankruptcy rate and for the change in

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business bankruptcy rate from now until five-quarters from now.
The forecasts then can be used to guide the creditor's strategy
in granting consumer credit and business credit.

2.4.2. The Variables Being Forecast

The objective is to forecast bankruptcy <u>rates</u> as distinct from
the absolute number of bankruptcies.[5] Analysis of the "rate"
permits one to control for changes in the population of firms or
individuals eligible for bankruptcy and, thus, permits one to
isolate the true change in tendency to become bankrupt.

The "Consumer Bankruptcy Rate" is;

> (# of Bankrupt Individuals during the Quarter) divided by
> (Population Aged Fifteen Years or More)

Children are excluded since they cannot become bankrupt.

The "Business Bankruptcy Rate" is;

> (# of Bankrupt Establishments during the quarter) divided by
> (# of Establishments)

Bankruptcy data is obtainable from the Department of Consumer and
Corporate Affairs. Data on the total number of establishments is
obtainable for a fee from the "Business Establishment" unit of
Statistics Canada. Population data is available free-of-charge
from Statistics Canada.

The dependent variable used in regression analyses is a three-

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[5] Actually, for the purpose of regression analysis we use
the <u>change in</u> bankruptcy rates as the dependent variable. We
explain this decision in section 2.4.2.1.

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quarter moving average of these bankruptcy rates. The latter seems to provide a fairer representation of the tendency to be bankrupt at any point in time than does the raw bankruptcy rate.

Each of these bankruptcy rates is calculated quarterly for the period 1981 Q1 to the latest available (1992 Q2) for the following units of the canadian economy;

Consumer Bankruptcies;

1. Canada
2. each province separately
3. the maritime region (ie. Newfoundland + Nova Scotia + New Brunswick + PEI)

Data for the maritime region as a whole also are tabulated, given the small number of bankruptcies in each of the constituent provinces.

Business Bankruptcies;

1. Canada
2. each province separately
3. the maritime region (ie. Newfoundland + Nova Scotia + New Brunswick + PEI)
4. Each of seven industrial sectors; Primary, Manufacturing, Construction, Transportation & Communication, Finance, Trade, and Services.
5. Each industrial sector in each province (eg. Ontario Services or BC Manufacturing)

A user of the Real Economics Inc. system could, thus, forecast movements in bankruptcy rates in any or all of fifty-eight portions of the canadian economy. In fact, though, we believe that this is not the best use of the system. At several points in this document we argue that a creditor should focus upon forecasting canadian consumer bankruptcy rates and cross-industry business bankruptcy rates, with only selective attention to constituent regions and industries. There are two reasons for this;

a. In some of the categories (eg. Saskatchewan Manufacturing) the

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number of bankruptcies is small enough to jeopardize the validity of the statistical methods employed.

b. The difference in the pattern of bankruptcy rates across provinces, even across sectors is surprisingly small. This point, in combination with a. above makes it relatively unimportant for one to be concerned with forecasting the difference between, say, the consumer bankruptcy rate for Canada and that for Ontario.

We note also that two of the seven industrial sectors are not normally considered by creditors as part of the category "Commercial & Industrial Loans". These are Primary industries and Finance. A large portion of Finance is, in fact, creditors themselves and Primary Industries include elements which are almost entirely unrelated in business terms (eg. agriculture and mining). Thus, we focus on the remaining five sectors; Manufacturing, Construction, Transportation etc., Trade and Services. Real Economics, Inc. does, however, continue to provide all of the data necessary to generate forecasts for the two omitted sectors.

Consider the statistical relationships between canadian bankruptcy rates and rates in various constituencies over the period 1981 Q1 as expressed in the R-squared values associated with simple regressions;

Canadian Consumer Bankruptcy Rate as a Function of:	R-Squared
Maritimes Consumer Bankruptcy Rate	0.949
Quebec Consumer Bankruptcy Rate	0.913
Ontario Consumer Bankruptcy Rate	0.928
Manitoba Consumer Bankruptcy Rate	0.961
Saskatchewan Consumer Bankruptcy Rate	0.851
Alberta Consumer Bankruptcy Rate	0.890
BC Consumer Bankruptcy Rate	0.573

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<u>Canadian Business Bankruptcy Rate as a Function of:</u>   <u>R-Squared</u>

Manufacturing Bankruptcy Rate	0.925
Construction Bankruptcy Rate	0.708
Transportation etc. Bankruptcy Rate	0.930
Trade Bankruptcy Rate	0.942
Services Bankruptcy Rate	0.977

On the consumer side, it would seem that the maritimes, Quebec, Ontario, and Manitoba each has bankruptcy rates which move very closely with the canadian rate. The best strategy likely is to use the forecast for each of these four regions along with the forecast for Canada as a whole in order to provide a set of forecasts for <u>Canada</u>. Inevitably, these five forecasts possess a consistent pattern. Furthermore, the creditor is much more likely to base its strategy on a <u>set</u> of forecasts which show a particular pattern, rather than on any one number (ie. one overall forecast for Canada).

British Columbia and, perhaps, Saskatchewan and Alberta, have bankruptcy rates which move somewhat independently of the canadian rate. These regions may warrant separate forecasts. This latter exercise, however, entails the usual hazard associated with the use of smaller sample sizes -- that is, increased random movement in the bankruptcy rate.

On the business side, each sector apart from Construction moves exceedingly closely with the overall rate for business. (In fact, this overall rate is the sum of each of the five above and, thus, excludes Primary industries and Finance). The bankruptcy rates for Manufacturing, Transportation, Trade and Services need not be forecast separately, rather the forecasts for each of these should be combined with the overall business bankruptcy rate forecast to generate a forecast for all canadian "Commercial & Industrial Loans").

The Construction sector may warrant separate analysis. The distinctiveness of Construction is consistent with the popular impression that loan losses associated with building (ie. construction and commercial real estate lending) are somewhat independent of loan losses associated with other types of business activity.

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Despite the apparent separateness of one or more provinces and one industrial sector, the focus of the system is very much upon generating two broad forecasts of bankruptcy rate; for canadian individuals (ie. the consumer bankruptcy rate) and for canadian businesses. As explained already, we rely not only on the single forecasts for each of these two rates but also on the forecasts for constituent economic units; regions in the case of consumer rates and sectors in the case of business rates. The bankruptcy rates associated with the constituents move in tandem with the overall rates and the various forecasts offset each others' errors to provide a set of forecasts with a clear and compelling signal.

We note two extensions to this system;

a. One might justifiably utilize forecasts for business bankruptcy rates by region, as has been done for consumer loans. Real Economics, Inc. provides all data necessary for this exercise. Decomposition by industry has been favoured here in the case of business loans because creditors typically decompose their portfolio of Commercial & Industrial loans in this manner.

b. The Real Economics, Inc. system emphasizes 5-quarter forecasts for bankruptcy rates. Nevertheless, forecasts for 6, 7 or 8 quarters are as good or better. Thus, we advise performing such forecasts (with appropriately lagged values of explanatory variables) as a supplement to the 5-quarter forecasts. This is yet another means through which the system generates a significant number of consistent, yet distinct forecasts of the same key phenomena; the future change in consumer and business bankruptcy rates. This discussion concerning alternative lags is pursued in its proper place in section 2.4.3 on "The Lag Structure of Forecasts".

2.4.2.1 Forecasting Bankruptcy Rates versus Forecasting Change in Bankruptcy Rates

One technique which we have found to improve our forecasting power is not to forecast bankruptcy rates directly, but to forecast the change in bankruptcy rate from now until five quarters from now and to add this projected change to the current bankruptcy rate, thus obtaining indirectly a forecast for the bankruptcy rate.

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This point is more statistical than substantive, however it does affect the relative importance of the explanatory variables, in particular the "Credit History" variable.

2.4.3. The Variables Used to Generate Forecasts

A number of principles govern our choice of explanatory variables;

a. the proposition that the credit risk associated with a region, industry or entire economy can be evaluated much the same way as lenders evaluate the credit risk associated with an individual borrower. Each region or industry, as well as the entire economy, is viewed as possessing an "economic condition", a "debt burden" and a "credit history". Each of these concepts is operationalized through the use of a specific explanatory variable.[6]

b. We wish to employ variables the values of which are reported for each element of the economy for which a bankruptcy-rate forecast is desired. For example, "Unemployment Rate" is available for Canada, for each province, for each industry and for each industry/province combination; "Money Supply" is not.

In general, we employ as explanatory variables for each forecast model the analogous form of the variable which we use for the Canada-wide forecast. For example, the Unemployment Rate for Services industries is used to forecast the bankruptcy rate for services industries; The Unemployment Rate for Canada is used to forecast the bankruptcy rate across consumers in Canada.

Using analogues of the three standard variables for all forecast models keeps the system conceptually clear and renders the forecasts more readily comparable.

c. We favour variables which are standard enough that they are

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[6] Certain additional explanatory variables are proposed in Section 2.4.10, "Alternative Specifications of the System".

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likely to continue to be tabulated by Statistics Canada and likely are tabulated in other countries (eg. US, UK). The latter attribute would render forecasts for Canada comparable with those in other countries and would enable an international bank more easily to use the system to manage an international portfolio of loans.

Economic Condition; As the measure of general economic condition in a portion of the economy we have selected "Unemployment Rate (Seasonally-Adjusted)". Other candidates which yield good forecast results include "GDP" and "Wages, Salaries and Other Labour Income".

In forecasts of consumer bankruptcies in Canada, the relevant explanatory variable is "Unemployment Rate (Seasonally-Adjusted) for Canada". In forecasts of business bankruptcies in the Construction Industry across Canada, the relevant explanatory variable is "Unemployment Rate (Seasonally-Adjusted) for the Construction Industry in Canada".

We defend the choice of Unemployment Rate on the following grounds;

1. Statistics Canada takes great care in tabulating labour force data due to the attention accorded them by the public.

2. Labour force data is available for Canada, for provinces, for industrial sectors, for province/sector combinations, even for metropolitan areas.

3. Items #1 and #2 also apply to other industrialized countries.

We show in the empirical portions of this application, that the forecast results for "unemployment rate" are entirely consistent with those for alternative measures of general economic condition.

Debt Burden; As in the case of an individual, a creditor should be concerned with the debt outstanding and associated payments

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due in whatever portion of the economy is under consideration.

We calculate Debt Burden as follows;

For consumer bankruptcies;

[(Interest Rate) times (Loans Outstanding)]

divided by (Personal Income)

where; "Interest Rate" is the Interest Rate on Consumer Credit

"Loans Outstanding" is the inflation-adjusted dollar-value of Commercial Bank Personal Loans

"Personal Income" is "Wages, Salaries and Other Supplementary Labour Income"

The idea behind this formulation of "Debt Burden" is to express interest payments due in relation to the capacity of individuals to make such payments.

The Interest Rate on Consumer Credit is available for Canada on a weekly basis.

Commercial Bank Personal Loans is available for Canada and by province on a quarterly basis.

Personal Income is available for Canada and by province on a quarterly basis.

For business bankruptcies;

[(Interest Rate) times (Loans Outstanding)]

divided by (Corporate Profits)

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where;

"Interest Rate" is the Interest on Business Credit

"Loans Outstanding" is the inflation-adjusted dollar value
of Commercial Bank Business Loans

"Corporate Profits" is Corporate Profits

The Interest Rate on Business Credit is available for Canada on a
weekly basis.

Commercial Bank Business Loans is available for Canada and by
industrial sector on a quarterly basis.

Corporate Profits is available for Canada and by province (but
apparently not by industrial sector) on a quarterly basis.

The tabulation of this variable for a specific category of credit
reflects common-sense subject to data availability. The Debt
Burden for canadian Construction, for example, is;

(Interest Rate on Business Credit for Canada) times (Loans to
canadian Construction) all divided by (Corporate Profits for
Canada)

Credit History; Some portions of the economy consistently have
higher bankruptcy rates than others. Ontario, for example,
generally has much higher rates than the Maritimes (most likely
because Ontarians have so much more debt on which to default).
This fact, though, is not quite as useful for our purposes as it
might seem. The reason is that we find it most effective to
forecast, not bankruptcy rate five-quarters from now but, the
change in bankruptcy rate from now until five-quarters from now.
This projected change is then added to the present rate to yield
a forecast for the future bankruptcy rate. In order for "Credit
History" to matter under our methodology it must be true that the
change in bankruptcy rate over the next five-quarters is a
function of such past changes.

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In fact, the change is bankruptcy rates is a function of past changes and inclusion of this explanatory variable is worthwhile. However, when one forecasts the raw bankruptcy rate (rather than the change) and includes the lagged value of bankruptcy rate as an explanatory variable, the latter is overwhelmingly significant. Much experience with this issue, though, confirms that the way to generate the best forecasts of bankruptcy rate is to forecast the change and to add this estimate to the current rate.

So, the representation of "Credit History" then is;

> the <u>lagged</u> value of the dependent variable, which under our methodology is the change in bankruptcy rate

2.4.4. Summary of the Approach to Selecting Variables

In general, then, we employ the following general form for the forecast models;

$$Y = f(X1, X2, X3)$$

where;   Y is the Bankruptcy Rate

X1 is a measure of Economic Condition

X2 is a measure of Debt Burden

X3 is a measure of Credit History

We have chosen specific variables to represent the three explanatory "concepts" above. "Economic Condition" is represented by the Unemployment Rate, "Debt Burden" is represented by the interest rate times debt, all divided by capacity to pay (ie.

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personal income or corporate profits). "Credit History" is the lagged value of Y.

Typically, each explanatory variable utilizes the data which correspond most sensibly to the specific bankruptcy rate which one wishes to forecast (eg. the unemployment rate in Manitoba for the forecast of Manitoba Consumer Bankruptcies).

It is important to realize that certain alternative variables also generate good results with a high level of explanatory power. We shall develop this point in section 2.4.10, "Alternative Specifications of the System".

2.4.5. The Lag Structure: How Far in Advance Do We Forecast Bankruptcy Rates?

One of the key elements of the inventive idea is the realization that bankruptcies follow other economic phenomena with a very substantial lag. A forecast horizon of a year or more not only increases the explanatory power of the models, but renders the forecasts usable for strategic planning by creditors.

Immediately below, we show the striking increase in the explanatory power of our general models as the forecast horizon lengthens.

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For Consumer Bankruptcies across Canada;

Explanatory Variables Lagged by; .	Model R-Squared
1 quarter	0.558
2 quarters	0.659
3 quarters	0.734
4 quarters	0.802
5 quarters	0.854
6 quarters	0.873
7 quarters	0.869
8 quarters	

For Business Bankruptcies across Canada;

Explanatory Variables Lagged by;	Model R-Squared
1 quarter	0.561
2 quarters	0.692
3 quarters	0.730
4 quarters	0.761
5 quarters	0.791
6 quarters	0.834
7 quarters	0.879
8 quarters	0.911

The Real Economics Inc. system emphasizes a five-quarter lag. This might seem odd in light of the data above which implies greater explanatory power at a lag of 6, 7 or 8 quarters. We favour the five-quarter lag because with such a lag all three explanatory variables are significant. At lags of 7 quarters and beyond, typically only the Economic Condition variable is significant. Use of such a lag structure for forecasting would seem to entail excessive reliance on one variable.

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Note also that the lags for 6 quarters or more are considered in the forecasting system. While the bulk of forecasts generated (eg. by industrial sector, by region) are with a 5-quarter lag, we also generate the 6, 7 and 8-quarter forecasts for consumer and business bankruptcy rates by utilizing data from 1, 2 and 3 quarters ago, respectively. This technique yields three more forecasts of bankruptcy rates 5-quarters hence; The latter tend to reinforce conclusions drawn from the standard 5-quarter forecasts for Canada, the regions and the industrial sectors.

Finally, one should not consider our approach to the issue of lag-structure as sacrosanct. A user of the Real Economics Inc. system easily could adapt the system so as to emphasize, say, a 6-quarter lag. Furthermore, the user might wish to have individual explanatory variables lagged differently (eg. 5-quarters for Debt Burden and 6-quarters for Economic Condition). In general, we have not generated increases in explanatory power through varying the lag structure in this way, but we remain open to such possibilities.

2.4.6. Forecasting Methodology

We do not emphasize convoluted or obscure econometric methods. We find that our explanatory power is high and that our forecasting results are good through the use of standard statistical techniques.

2.4.6.1 Data: All data necessary to use the system is available from Statistics Canada. Data on "# of business establishments" is available from the Business Register Division of StatsCan. All other data is available through the "CANSIM" database and can be obtained most conveniently via the "CANSIM CD-ROM".

The data upon which regressions are based begins in 1982 Q1. Thus, models generated now would utilize 37 quarters of data (not 42 quarters of data because the dependent variable is the change in the bankruptcy rate from now until five-quarters from now; Thus, the last values of the explanatory variables which are usable are the ones corresponding to the period five-quarters ago).

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2.4.6.2 Statistical Methods; We use Ordinary Least Squares regression to estimate regression parameters. In general, the error terms so generated are highly-autocorrelated. We use the Cochran-Orcutt method to deal with this. The latter proves entirely successful in the case of regressions involving business bankruptcies, but only moderately successful in the case of consumer bankruptcies. As we explain four paragraphs below, it may suit our purpose to use 'raw' forecasts rather than forecasts adjusted for autocorrelation.

For each regression we also perform certain other diagnostics. We check for colinearity problems through stepwise regression and find absolute parameter stability, thus implying (along with high values of R-squared) that models likely would perform well in forecasting bankruptcy rates.

2.4.6.3. Generating Forecasts from Regression Equations; This area is somewhat problematic. In Exhibit Two, we generate 95 test forecasts. Application of the Cochran-Orcutt procedure to so many regression equations simply is not worth the return. Autocorrelation does not, after all, bias parameter estimates.

A typical alternative to Cochran-Orcutt for the purposes of generating forecasts is the so-called "Add-Factor Method" in which one finds the "typical error" associated with the regression parameters used for the forecast and adds this to the raw forecast generated by these parameters. The problem with the Add-Factor method is this; The "typical error" associated with the regression model is that for 5 or more quarters ago. This is because the dependent variable is the change in bankruptcy rate over the next five quarters; The data for the explanatory variables during this next five quarters cannot be used in regressions through which forecasts are generated. Because of this shortcoming the Adjustment Factors generated through the Add-Factor Method actually render our forecasts more error-prone than forecasts without the Adjustment Factor.

So the Test Forecasts reported in Exhibit Two are 'raw' in that they have not been adjusted for autocorrelation. Why, then, do we bother applying the Cochran-Orcutt procedure at all to the 'current' regressions reported immediately below and in Exhibit One? We do this simply to show the approximate degree of

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overstatement in R-squared values due to autocorrelation.

2.4.7. Regression Results

We report immediately below and in Exhibit One regression results which would be used to forecast the change in bankruptcy rate from now (1992 Q4) until five-quarters from now (1994 Q1).

There is a regression model for each portion of the economy for which a bankruptcy-rate forecast is desired. There is an additional model for each desired forecast horizon (eg. 5-quarters versus 6-quarters). All regression models are reported in Exhibit One. Below we include only the overall models for canadian business bankruptcies and for canadian consumer bankruptcies, each with a 5-quarter forecast horizon.

Consumer Bankruptcies for Canada with a 5-Quarter Horizon:

Pre Cochran-Orcutt:

$b0 = +0.1527$
$b1 = -0.0342 \quad t1 = -5.895$
$b2 = +0.2018 \quad t2 = +6.588$
$b3 = +0.1265 \quad t3 = +1.745$

R-Squared = 0.866
Durbin-Watson = 0.596

Post Cochran-Orcutt:

$b0 = +0.1108$
$b1 = -0.0348 \quad t1 = -5.034$
$b2 = +0.1400 \quad t2 = +5.180$
$b3 = +0.1905 \quad t3 = +2.054$

R-Squared = 0.808
Durbin-Watson = 1.366

where:

Y is _Change in_ "Total Quarterly Consumer Bankruptcies in Canada divided by Population of Canada Aged 15 Years or More" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

X2 is "Real Interest Rate on Consumer Credit" times

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"Total Chartered Bank Personal Loans Outstanding in Canada (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income for Canada (inflation-adjusted)" at time t

X3 is the value of Y at time t

Business Bankruptcies for Canada with a 5-Quarter Horizon:

Pre Cochran-Orcutt:

b_0 = +0.0020
b_1 = -0.0264 t_1 = -9.680
b_2 = +0.0002 t_2 = +2.015
b_3 = +0.1725 t_3 = +2.320

R-Squared = 0.791
Durbin-Watson = 0.659

Post Cochran-Orcutt:

b_0 = +0.0011
b_1 = -0.0287 , t_1 = -8.253
b_2 = +0.0002 t_2 = +2.169
b_3 = +0.0775 t_3 = +1.142

R-Squared = 0.731
Durbin-Watson = 1.963

where:

Y is Change in "Total Quarterly Business Bankruptcies in Canada divided by Number of Business Establishments in Canada" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

X2 is "Real Interest Rate on Business Credit" times "Total Chartered Bank Business Loans Outstanding in Canada (inflation-adjusted)" all divided by "Corporate Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

These key regression models prompt a number of comments;

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1. R-Squared values associated both with the consumer bankruptcy model and with the business bankruptcy model are high. This is especially true considering that the regressions are 'difference' models (ie. in which we attempt to explain change in bankruptcy rates rather than bankruptcy rates themselves); Difference models rarely possess R-Squared values as high as 0.8. One would expect such models to yield good forecasts. In Exhibit Two, we illustrate the forecasting power of our models using 'test forecasts' in which actual values of Y are 'forecast' using only data which was available at the time of the forecast. In fact, these successful forecasts are generated from historical regression models which are based on fewer observations and which have lower R-Square values than the current models shown above.

2. It appears that the consumer bankruptcy model has greater explanatory power than the business bankruptcy model (at least with a 5-quarter lag). This may be due to the higher autocorrelation present in the consumer model. While use of the Cochran-Orcutt procedure removed virtually all of the autocorrelation in the business model, the consumer model retains a certain amount of autocorrelation which, while not creating any bias in the parameter estimates, does tend to exaggerate R-Squared values somewhat.

3. R-Squared values generally are lower for the 'constituent' forecasts reported in Exhibit One (eg. regional forecasts for consumer bankruptcies and industrial sector forecasts in the case of business loans). This is not surprising given that the latter utilize much smaller numbers of bankruptcies per quarter.

4. The regression parameters have the expected signs for the "Debt Burden" variable and for the "Credit History" variable. One of the provocative statistical results in this exercise, however, is the sign attached to the "Economic Condition" variable. The regression results imply unambiguously a negative relationship between Unemployment Rate and later change in bankruptcy rate; That is, high unemployment rates are followed in 5-quarters by decreases in the bankruptcy rate. To the extent that bankruptcy rates have been considered at all by economists, they have been presumed to vary with economic conditions in the obvious way. The results of our analysis are so inconsistent with this presumption that we undertook to scrutinize the negative sign on the Unemployment Rate variable in every way conceivable.

The following measures were invoked in order to attempt to uncover a spurious negative relationship between the Unemployment

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Rate and the change in bankruptcy rates over the next five quarters;

a. We use alternative specifications of the regression model; simple regression of Unemployment Rate on Y, then, Unemployment and Debt Burden on Y, etc. in the manner of a stepwise-regression. We do this both for consumer bankruptcies and for business bankruptcies.

b. We divide the entire data set into three equal portions and then run regression on each period separately to see if the negative sign on the Unemployment Rate variable is observed on each sub-sample independently. We do this both for consumer bankruptcies and for business bankruptcies.

c. We use alternative measures of economic condition; "Wages, Salaries and Supplementary Labour Income" and "Gross Domestic Product". We do this both for consumer bankruptcies and for business bankruptcies.

Under each of these procedures the surprising relationship between economic condition (ie. unemployment rate) and future change in bankruptcy rates is maintained. In addition, we point out that consistently very high t-values (ie. about 5) are attached to the unemployment rate parameter, that the negative sign on the unemployment rate variable is observed for each of the 'constituent' regressions shown in Exhibit One, and that the test forecasts shown in Exhibit Two are highly successful despite the use of the peculiar negative coefficient.

Thus, we accept the regression results above because they have proved immensely robust and because they are useful for the purposes of our future customers.

5. There appear to be no serious technical problems associated with these regression models (eg. colinearity). Regression diagnostics related to colinearity, scrutiny of the Unemployment Rate parameter etc. are reported as part of the Real Economics, Inc. product on a diskette titled "Detailed Regression Diagnostics".

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2.4.8. The System as a Product

2.4.8.1; The Product.

The Real Economics Inc. system is not an academic project but a commercial product which will be sold to creditors of all kinds in several industrialized countries (eg. banks in all countries, trust companies and mortgage loan companies in Canada, Savings & Loans in the US, Building Societies in the UK, etc.).

We intend to market the system as an "installed" product in which Real Economics inc. transfers the capability to generate forecasts of bankruptcy rates to the buyer (eg. a chartered bank). The buyer will receive; a. About 90 diskettes, some of which contain data, some of which contain statistical models generated from the data and some of which contain regression "diagnostics". b. A "Guide" to the diskettes. c. A series of instructional sessions by Real Economics, Inc. in the techniques which we use to run the system, d. This patent application as a tool for transferring the knowledge necessary to run the system. e. Ongoing consultation and product refinement from Real Economics, Inc., and f. the legal right to use the system for the purposes of credit risk management.

The canadian version of the product is ready for sale. Work is in progress on a US version and on a UK version of the product. In addition, we intend to develop versions of the product for Japan, Germany, France, Italy and possibly other countries. We intend to file for patent protection in each of these countries as well.

Sale of the product through "installation" (ie. in which we transfer the forecast capability to the customer) is most attractive because creditors are unlikely to allow the system to guide their aggregate lending decisions unless they understand the system intimately. In addition, the terms of purchase/ licensing agreements likely will permit the customer to modify the product according to its perceived needs.

We do recognize the possibility of sale of the product through "subscription", in which the buyer receives forecasts and accompanying analysis on a quarterly basis from Real Economics, Inc., as distinct from sale through "installation". This alternative might be especially attractive to smaller institutions.

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2.4.8.2. Implementation.

We envision the transfer of the forecast-capability to the economics department of the buyer. However, the ultimate user of the forecasts is the buyer's lending function. It appears that forecasts of consumer bankruptcies are relevant to credit-granting practices in the areas of; Personal Loans, Credit Cards and Mortgage Loans. Together, these three account for about 70% of the value of loans issued by canadian financial intermediaries. The forecasts of business bankruptcies are relevant to credit-granting practices in the area of "Commercial & Industrial Loans". As the system entails the application of statistical analysis to large numbers of business bankruptcies, it is applied most sensibly to the mass of loans to small and medium-sized businesses.

The system is intended to assist the creditor in answering the question; Do we expand, contract or stabilize each of our various types of lending activities? Expansion/Contraction of lending can be effected through some combination of credit standards, credit-pricing and credit-collection.

The system does not merely allow creditors to contract lending before an increase in bankruptcies; It allows them to expand lending before a decrease in bankruptcies. It is, thus, of equal benefit in the areas of avoiding threat and exploiting opportunity.

2.4.9: The System in Light of Bankruptcy Legislation

Revisions to the Bankruptcy and Insolvency Act permit certain businesses and consumers to cancel their debt obligations or to delay debt re-payment for a period of one-month, or occasionally longer.

There are two ways in which this development is relevant to users of the Real Economics Inc. system;

1. The power of creditors over distressed borrowers appears to

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have been weakened, thus intensifying the need to forecast aggregate borrower default accurately and to adjust lending strategy accordingly.

2. The data used to develop the Real Economics Inc. forecast models deals with pre-revision bankruptcies, rather than with post-revision "bankruptcies" and "proposals". For forecasting purposes, the question is: Will post-revision "bankruptcies + proposals" bear the same relationship to our explanatory variables as pre-revision "bankruptcies"? Might it be that proposals will occur with slightly less of a lag than pre-revision "bankruptcies", given that borrowers might resist the former status less than the latter? Might de jure bankruptcy status thus occur with a slightly longer lag post-revision than pre-revision?

First, both proposal status and bankruptcy status typically entail substantial loss to the creditor. Thus, a slight shift forward of one and a slight shift backward of the other would seem essentially to maintain the distribution of credit risk across time.

Secondly, the proposal period appears designed to last about one-month. Given that the Real Economics Inc. system utilizes lags of five quarters (ie. fifteen months) or more, any such alterations in the underlying lag between economic fundamentals and loan default would seem to have only modest consequences for users of the system.

Nevertheless, Real Economics, Inc. views continual system-updates as its first priority; New generations of the system surely will reflect attention to such nuances.

2.4.10 Alternative Specifications of the System

We have given much attention, while preparing this document, to ensuring that all details necessary to use the invention profitably have been included. However, the product derived from the invention is a living entity. It will develop continually via research by Real Economics Inc. and by customers according to the terms of purchase/licensing agreements. The economics departments of the large canadian financial intermediaries, for example, are populated by 15 or more professionals each of whom has the skills suitable for refining our product.

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Consider some very basic modifications and their (potential) consequences;

1. Future versions of the system surely will include new explanatory variables. Two which show particular promise are "Accumulated Wealth" and "Liquidity". The former could be measured by the sum of "Retained Earnings" or "Savings" (in the case of businesses and consumers, respectively) over the last several quarters. "Liquidity" can be measured in several ways, the most basic being a simple ratio of "Cash" to "Total Assets".

2. As an alternative to "Unemployment Rate" as a measure of economic condition, we substituted, alternately, "GDP" and "Wages, Salaries and Supplementary Labour Income". The regression results so generated were entirely consistent with use of the Unemployment Rate variable.

3. In the calculation of our Debt Burden variable, we experimented with including or excluding Personal Income as a denominator. Regression coefficients differed in the two cases, but overall explanatory power was comparable.

4. Extending the forecast-horizon from 5 quarters to 6, 7 or 8 quarters actually increases the overall explanatory power of the regression (at least before a Cochran-Orcutt transformation), but renders one or more explanatory variables statistically insignificant.

5. Users of the system may wish to use regional constituents in forecasting business bankruptcies (eg. Ontario business bankruptcies etc.) rather than industry constituents such as Services bankruptcies. Data for such purposes is maintained by Real Economics, Inc.

Opportunities for 'tinkering' with our system are endless.

One of the merits of the system is its flexibility; It can accommodate modifications to existing variables or variables not considered at all by Real Economics Inc.. It works very well with the basic statistical techniques described in this document, but, no doubt, eventually will be subject to state-of-the-art econometrics.

There is no question that the intellectual and financial resources of hundreds of bankers, economists and statisticians

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over a period of years will yield a more sophisticated version of
our product.

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Section 3: Evidence Concerning "Novelty", "Utility" and "Ingenuity" of the System

As stated in the Guide to Patents, the criteria which govern patentability of an invention are: Novelty, Utility and Ingenuity. There appears not to be any requirement that the inventor address these three attributes explicitly in the patent application. Nevertheless, we include this short section in order to emphasize certain links between other material in this application and one or more of the three criteria, as well as to introduce additional facts which bear upon the patentability of the Real Economics, Inc. system.

3.1 Novelty and Ingenuity:

Our review of the Business Periodicals Index as well as the leading texts in the field of banking reveals no credit risk management system which is at all similar to this one. Section 2.2, "The Nature of Processes Previously Used and Associated Difficulties" summarizes existing practices which one might wish to compare with our system. The discussion in that section, we feel, establishes the originality of our process.

One might wonder why an invention of such apparent commercial value to creditors has not emerged until now. One answer is that, while commercial banking itself has a history of several hundred years, the data and technology necessary to develop this system would not have been available even five years ago.

In order to establish the ingenuity of our work, we describe the significant thought processes which preceded formal product development. (Please see Section 2.3, "The Inventive Idea and How It Overcomes Difficulties with Existing Methods".)

3.2 Utility:

The system is 'useful' in at least two ways; 1. It works -- that is, it generates accurate forecasts, and 2. These forecasts provide something of value to creditors. The accuracy of the forecasts is established in Exhibit Two, "Test Forecasts", in which we 'forecast' known changes in bankruptcy rates using only data which would have been available at the beginning of the forecast horizon. The value to creditors is obvious;

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Foreknowledge of the extent of credit risk (in the form of increasing or decreasing bankruptcy rates) allows a creditor to expand, contract or stabilize its lending activities. In this regard, please see section 2.4.8., "The System as a Product".

Though we see this invention primarily as a marketable product, we also feel that it entails certain macroeconomic benefits; namely, the allocation of credit more efficiently than is now the case. Loan default occurs, by definition, when an uncreditworthy borrower has been granted a loan. The Real Economics, Inc. system allows creditors better to match loanable funds with borrowers who will generate a return on those funds adequate to honour their debt obligations.

In the next section, we elaborate on this latter idea.

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Section 4: Some Theory Associated with the System

We consider many types of economic variables to fall into one of two categories; Category One -- variables which embody a financial gain or loss to certain market participants. Obvious examples include exchange rates, stock prices and interest rates. Individuals and organizations make or lose money as a result of movements in these variables. Category Two -- variables which embody no such financial gain or loss (not _directly_, at any rate). Examples here include current account balance and the money supply.

Variables in Category One, for obvious reasons, constantly are scrutinized. Market participants attempt to forecast their movements using different types of analyses. The result is that markets, say, for hard currency and for stocks are very 'efficient' -- That is, such markets reflect all available information and, thus, leave no opportunity for making excess profit systematically through trading based on an unsophisticated strategy.

One of the premises of the Real Economics Inc. system is that bankruptcy rate is, in fact, a Category One economic variable, though typically it is treated as a Category Two variable.

Debt, by definition, does not carry the prospect of upside opportunity (as does equity). It does, however, carry the threat of downside loss (ie. default). Thus, one can construe the 'return' associated with debt to be the absense of default. Using this perspective, it is apparent that bankruptcy rates represent something to creditors much like what movements in the S&P 500 represent to investors in a broad portfolio of stock.

We show conclusively in this document that, unlike stock price movements, bankruptcy rates are quite predictable using relatively simple statistical models. This implies that the market for credit is _not_ 'efficient'; That is, a creditor can, using a system such as ours, systematically "beat the market". A creditor systematically can avoid bad debt (and thus increase its 'return') without reducing average loan volume over the long-run. The creditor simply matches its lending over time with what it knows to be movements in aggregate credit risk over time.

But this must be a disequilibrium situation. If, hypothetically, all issuers of credit in the economy employed sound methodologies to assess aggregate credit risk, then such opportunities for

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systematic gain would disappear. However, creditors still would be attentive to their forecasts in the hope of finding a glimmer of market inefficiency -- as do present-day traders of currency and stock.

In this manner, we feel that, through the Real Economics, Inc. system, we have uncovered a type of inefficiency in the market for credit and that we offer some hope for correcting the deficiency.

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Exhibit 1: Complete Regression Results

We report immediately below regression results which would be used to forecast the change in bankruptcy rate from now (1992 Q4) until five-quarters from now (1994 Q1).

In general, it is not advisable to use the 'sub-national' models (eg. for an industry or region) to forecast the bankruptcy rate in that industry or region. These sub-national models and their associated forecasts are best used to form a set of indicators through which to forecast bankruptcy rates for canadian consumers and bankruptcy rates for canadian businesses. (We do, however, consider the advisability of separate forecast for the Construction and for BC consumer bankruptcies.)

Consumer Bankruptcies for Canada with a 5-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.1527$ $b0 = +0.1108$
$b1 = -0.0342$ $t1 = -5.895$ $b1 = -0.0348$ $t1 = -5.034$
$b2 = +0.2018$ $t2 = +6.588$ $b2 = +0.1400$ $t2 = +5.180$
$b3 = +0.1265$ $t3 = +1.745$ $b3 = +0.1905$ $t3 = +2.054$

R-Squared = 0.866   R-Squared = 0.808
Durbin-Watson = 0.596   Durbin-Watson = 1.366

where:

> Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies in Canada divided by Population of Canada Aged 15 Years or More" between time t and t plus 5-quarters
>
> X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t
>
> X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in

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Canada (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income" for Canada (inflation-adjusted) at time t

X3 is the value of Y at time t

Consumer Bankruptcies for the Maritimes with a 5-Quarter Horizon

Pre Cochran-Orcutt: Post Cochran-Orcutt:

b0 = -0.0424   b0 = +0.0345
b1 = -0.0108   t1 = -1.783   b1 = -0.0149   t1 = -1.914
b2 = +0.0951   t2 = +6.621   b2 = +0.0714   t2 = +4.227
b3 = -0.1570   t3 = -1.625   b3 = -0.1754   t3 = -1.355

R-Squared = 0.763   R-Squared = 0.578
Durbin-Watson = 0.777   Durbin-Watson = 1.634

where:

Y is Change in "Total Quarterly Consumer Bankruptcies in the Maritimes Divided by the Population of the Maritimes Aged 15 Years or More" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for the Maritimes at time t

X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in the Maritimes (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income" for the Maritimes (inflation-adjusted) at time t

X3 is the value of Y at time t

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<u>Consumer Bankruptcies for Quebec with a 5-Quarter Horizon:</u>

Pre Cochran-Orcutt: Post Cochran-Orcutt:

    $b_0 = +0.3979$ $b_0 = +0.0830$
    $b_1 = -0.0405$ $t_1 = -6.219$ $b_1 = -0.0260$ $t_1 = -6.219$
    $b_2 = +0.1545$ $t_2 = +3.781$ $b_2 = +0.1632$ $t_2 = +3.781$
    $b_3 = -0.2098$ $t_3 = -2.257$ $b_3 = -0.2098$ $t_3 = -2.257$

    R-Squared = 0.812   R-Squared = 0.576
    Durbin-Watson = 0.574   Durbin-Watson = 1.738

where:

      Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies
      in Quebec divided by Population of Quebec Aged 15 Years
      or More" between time t and t plus 5-quarters

      X1 is "Unemployment Rate" (Seasonally-Adjusted) for
      Quebec at time t

      X2 is "Real Interest Rate on Consumer Credit" times
      "Total Chartered Bank Personal Loans Outstanding in
      Quebec (inflation-adjusted)" all divided by "Wages,
      Salaries and Supplementary Labour Income" for Quebec
      (inflation-adjusted) at time t

      X3 is the value of Y at time t

<u>Consumer Bankruptcies for Ontario with a 5-Quarter Horizon:</u>

Pre Cochran-Orcutt: Post Cochran-Orcutt:

    $b_0 = -0.1129$ $b_0 = -0.0308$

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b1 = -0.0270	t1 = -3.671	b1 = -0.0255	t1 = -3.606
b2 = +0.3451	t2 = +6.901	b2 = +0.2804	t2 = +6.612
b3 = +0.2377	t3 = +2.950	b3 = +0.3569	t3 = +4.387

R-Squared = 0.847   R-Squared = 0.8544
Durbin-Watson = 0.691   Durbin-Watson = 1.370 .

where:

Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies in Ontario divided by Population of Ontario Aged 15 Years or More" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Ontario at time t

X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in Ontario (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income for Ontario (inflation-adjusted) at time t

X3 is the value of Y at time t

Consumer Bankruptcies for Manitoba with a 5-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

b0 = +0.2815		b0 = +0.0857	
b1 = -0.0578	t1 = -5.785	b1 = -0.0389	t1 = -3.847
b2 = +0.2072	t2 = +7.230	b2 = +0.2118	t2 = +7.276
b3 = +0.1900	t3 = +2.564	b3 = +0.2529	t3 = +3.026

R-Squared = 0.855   R-Squared = 0.817
Durbin-Watson = 0.966   Durbin-Watson = 1.654

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where:

Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies
in Manitoba divided by Population of Manitoba aged 15
Years or More" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Manitoba at time t

X2 is "Real Interest Rate on Consumer Credit" times
"Total Chartered Bank Personal Loans Outstanding in
Manitoba (inflation-adjusted)" all divided by "Wages,
Salaries and Supplementary Labour Income" for Manitoba
(inflation-adjusted) at time t

X3 is the value of Y at time t

Consumer Bankruptcies for Saskatchewan with a 5-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.3492$ $b0 = +0.0906$
$b1 = -0.0465$ $t1 = -5.660$ $b1 = -0.0260$ $t1 = -3.419$
$b2 = +0.0469$ $t2 = +2.723$ $b2 = +0.0481$ $t2 = +2.532$
$b3 = +0.3090$ $t3 = +3.385$ $b3 = +0.2705$ $t3 = +2.218$

R-Squared = 0.724   R-Squared = 0.485
Durbin-Watson = 0.737   Durbin-Watson = 1.477

where:

Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies
in Saskatchewan divided by Population of Saskatchewan
Aged 15 Years or More" between time t and t plus 5-
quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Saskatchewan at time t

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X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in Canada (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income" for Saskatchewan (inflation-adjusted) at time t

X3 is the value of Y at time t

Consumer Bankruptcies for Alberta with a 5-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.2285$ $b0 = +0.0348$
$b1 = -0.0370$ $t1 = -4.110$ $b1 = -0.0172$ $t1 = -2.328$
$b2 = +0.3957$ $t2 = +3.293$ $b2 = +0.2307$ $t2 = +2.625$
$b3 = +0.0757$ $t3 = +0.610$ $b3 = +0.0633$ $t3 = +0.391$

$R\text{-Squared} = 0.665$ $R\text{-Squared} = 0.341$
$Durbin\text{-}Watson = 0.383$ $Durbin\text{-}Watson = 1.272$

where:

Y is _Change in_ "Total Quarterly Consumer Bankruptcies in Alberta divided by Population of Alberta Aged 15 Years or More" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Alberta at time t

X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in Alberta (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income" for Alberta (inflation-adjusted) at time t

X3 is the value of Y at time t

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Consumer Bankruptcies for BC with a 5-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.0429$ $b0 = +0.0315$
$b1 = -0.0162$ $t1 = -5.779$ $b1 = -0.0126$ $t1 = -3.376$
$b2 = +0.1270$ $t2 = +5.856$ $b2 = +0.0772$ $t2 = +3.380$
$b3 = +0.2636$ $t3 = +2.991$ $b3 = +0.2071$ $t3 = +1.507$

R-Squared = 0.866   R-Squared = 0.476
Durbin-Watson = 0.596   Durbin-Watson = 1.375

where:

Y is _Change in_ "Total Quarterly Consumer Bankruptcies
in BC divided by Population of BC Aged 15 Years
or More" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
BC at time t

X2 is "Real Interest Rate on Consumer Credit" times
"Total Chartered Bank Personal Loans Outstanding in
BC (inflation-adjusted)" all divided by "Wages,
Salaries and Supplementary Labour Income" for BC
(inflation-adjusted) at time t

X3 is the value of Y at time t

Consumer Bankruptcies for Canada with a 6-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.2611$ $b0 = +0.1851$
$b1 = -0.0456$ $t1 = -6.980$ $b1 = -0.0494$ $t1 = -5.826$

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```
b2 = +0.2177   t2 = +6.037      b2 = +0.1221   t2 = +3.791
b3 = -0.0227   t3 = -0.307      b3 = +0.0978   t3 = +1.013

R-Squared = 0.873               R-Squared = 0.785
Durbin-Watson = 0.657           Durbin-Watson = 1.404
```

where:

Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies in Canada divided by Population of Canada Aged 15 Years or More" between time t and t plus 6-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in Canada (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income for Canada (inflation-adjusted) at time t

X3 is the value of Y at time t

<u>Consumer Bankruptcies for Canada with a 7-Quarter Horizon:</u>

Pre Cochran-Orcutt: Post Cochran-Orcutt:

```
b0 = +0.3983                    b0 = +0.3983
b1 = -0.0588   t1 = -8.08       b1 = -0.0588   t1 = -6.366
b2 = +0.2232   t2 = +5.399      b2 = +0.2232   t2 = +3.493
b3 = -0.1349   t3 = -1.565      b3 = +0.1349   t3 = +0.258

R-Squared = 0.878               R-Squared = 0.794
Durbin-Watson = 0.591           Durbin-Watson = 1.293
```

where:

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Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies in Canada divided by Population of Canada Aged 15 Years or More" between time t and t plus 6-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in Canada (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income" for Canada (inflation-adjusted) at time t

X3 is the value of Y at time t

<u>Consumer Bankruptcies for Canada with an 8-Quarter Horizon:</u>

Pre Cochran-Orcutt: Post Cochran-Orcutt:

    b0 = +0.5310   b0 = +0.2973
    b1 = -0.0706   t1 = -8.518   b1 = -0.0710   t1 = -6.460
    b2 = +0.2215   t2 = +1.839   b2 = +0.0835   t2 = +2.204
    b3 = -0.1759   t3 = -1.777   b3 = +0.0223   t3 = +0.180

    R-Squared = 0.866   R-Squared = 0.788
    Durbin-Watson = 0.596   Durbin-Watson = 1.257

where:

Y is <u>Change in</u> "Total Quarterly Consumer Bankruptcies in Canada divided by Population of Canada Aged 15 Years or More" between time t and t plus 8-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

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X2 is "Real Interest Rate on Consumer Credit" times "Total Chartered Bank Personal Loans Outstanding in Canada (inflation-adjusted)" all divided by "Wages, Salaries and Supplementary Labour Income" for Canada (inflation-adjusted) at time t

X3 is the value of Y at time t

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Business Bankruptcies for Canada with a 5-Quarter Horizon:

Pre Cochran-Orcutt:

$b_0 = +0.0020$
$b_1 = -0.0264$ $t_1 = -9.680$
$b_2 = +0.0002$ $t_2 = +2.015$
$b_3 = +0.1725$ $t_3 = +2.320$

$R\text{-Squared} = 0.791$
$\text{Durbin-Watson} = 0.0.659$

Post Cochran-Orcutt:

$b_0 = +0.0011$
$b_1 = -0.0287$ $t_1 = -8.253$
$b_2 = +0.0002$ $t_2 = +2.169$
$b_3 = +0.0775$ $t_3 = +1.142$

$R\text{-Squared} = 0.731$
$\text{Durbin-Watson} = 1.963$

where:

Y is <u>Change in</u> "Total Quarterly Business Bankruptcies
in Canada divided by Number of Business Establishments
in Canada" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Canada at time t

X2 is "Real Interest Rate on Business Credit" times
"Total Chartered Bank Business Loans Outstanding in
Canada (inflation-adjusted)" all divided by "Corporate
Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

Manufacturing Bankruptcies for Manufacturing with a 5-Quarter Horizon:

Pre Cochran-Orcutt:

Post Cochran-Orcutt:

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b0 = +0.0021		b0 = +0.0004		
b1 = -0.0245	t1 = -6.570	b1 = -0.0140	t1 = -3.184	
b2 = +0.0004	t2 = +0.444	b2 = +0.0005	t2 = +0.565	
b3 = +0.1832	t3 = +2.188	b3 = +0.2594	t3 = +1.720	

R-Squared = 0.579
Durbin-Watson = 0.787

R-Squared = 0.295
Durbin-Watson = 1.668

where:

Y is <u>Change in</u> "Total Quarterly Manufacturing Bankruptcies in Canada divided by Number of Manufacturing Establishments in Canada" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canadian Manufacturing at time t

X2 is "Real Interest Rate on Business Credit" times "Total Chartered Bank Manufacturing Loans Outstanding in Canada (inflation-adjusted)" all divided by "Corporate Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

Construction Bankruptcies for Canada with a 5-Quarter Horizon:

Pre Cochran-Orcutt:

Post Cochran-Orcutt:

b0 = +0.0009
b1 = -0.0126   t1 = -6.321
b2 = +0.0040   t2 = +3.820

b0 = +0.0004
b1 = -0.0106   t1 = -3.926
b2 = +0.0016   t2 = +1.607

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$b3 = +0.0161$ $t3 = +0.175$ $b3 = +0.0158$ $t3 = +0.137$

R-Squared = 0.590   R-Squared = 0.378
Durbin-Watson = 0.566   Durbin-Watson = 1.625

where:

Y is <u>Change in</u> "Total Quarterly Construction
Bankruptcies in Canada divided by Number of
Construction Establishments in Canada" between time t
and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Construction at time t

X2 is "Real Interest Rate on Business Credit" times
"Total Chartered Bank Construction Loans Outstanding in
Canada (inflation-adjusted)" all divided by "Corporate
Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

<u>Transportation & Communication Bankruptcies for Canada with a 5-Quarter Horizon:</u>

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.0053$ $b0 = +0.0022$
$b1 = -0.0862$ $t1 = -4.50$ $b1 = -0.0681$ $t1 = -5.427$
$b2 = +0.0010$ $t2 = +1.46$ $b2 = +0.0010$ $t2 = +0.415$
$b3 = +0.0339$ $t3 = +0.358$ $b3 = -0.1050$ $t3 = -0.863$

R-Squared = 0.791   R-Squared = 0.491
Durbin-Watson = 0.659   Durbin-Watson = 1.826

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where:

Y is <u>Change in</u> "Total Quarterly Transportation &
Communication Bankruptcies in Canada divided by Number
of Transportation & Communication Establishments in
Canada" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Transportation & Communication at time t

X2 is "Real Interest Rate on Business Credit" times
"Total Chartered Bank Transportation & Communication
Loans Outstanding in Canada (inflation-adjusted)" all
divided by "Corporate Profits for Canada" (inflation-
adjusted) at time t

X3 is the value of Y at time t

<u>Trade Bankruptcies for Canada with a 5-Quarter Horizon:</u>

Pre Cochran-Orcutt:

b0 = +0.0027
b1 = -0.0368   t1 = -8.10
b2 = +0.0009   t2 = +1.32
b3 = -0.0001   t3 = -0.002

R-Squared = 0.751
Durbin-Watson = 0.742

Post Cochran-Orcutt:

b0 = +0.0014
b1 = -0.035   t1 = -6.15
b2 = +0.0008   t2 = +1.200
b3 = +0.0582   t3 = +0.655

R-Squared = 0.651
Durbin-Watson = 2.050

where:

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Y is <u>Change in</u> "Total Quarterly Trade Bankruptcies
in Canada divided by Number of Trade Establishments
in Canada" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Trade at time t

X2 is "Real Interest Rate on Business Credit" times
"Total Chartered Bank Trade Loans Outstanding in
Canada (inflation-adjusted)" all divided by "Corporate
Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

Services Bankruptcies for Canada with a 5-Quarter Horizon:

Pre Cochran-Orcutt:

b0 = +0.0026
b1 = -0.0002   t1 = -6.48
b2 = +0.0010   t2 = +1.53
b3 = -0.1120   t3 = -1.64

R-Squared = 0.736
Durbin-Watson = 0.860

Post Cochran-Orcutt:

b0 = +0.0006
b1 = -0.0001   t1 = -4.50
b2 = +0.0010   t2 = +1.46
b3 = +0.0339   t3 = +0.358

R-Squared = 0.578
Durbin-Watson = 2.50

where:

Y is <u>Change in</u> "Total Quarterly Services Bankruptcies
in Canada divided by Number of Services Establishments
in Canada" between time t and t plus 5-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for

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Services at time t

X2 is "Real Interest Rate on Business Credit" times "Total Chartered Bank Services Loans Outstanding in Canada (inflation-adjusted)" all divided by "Corporate Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

Business Bankruptcies for Canada with a 6-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

$b0 = +0.0024$ $b0 = +0.0013$
$b1 = -0.0326$ $t1 = -11.05$ $b1 = -0.0337$ $t1 = -7.964$
$b2 = +0.0004$ $t2 = +2.618$ $b2 = +0.0003$ $t2 = +2.401$
$b3 = +0.0329$ $t3 = +0.548$ $b3 = +0.0675$ $t3 = +0.810$

$R\text{-Squared} = 0.791$ $R\text{-Squared} = 0.750$
$\text{Durbin-Watson} = 0.659$ $\text{Durbin-Watson} = 2.067$

where:

Y is Change in "Total Quarterly Business Bankruptcies in Canada divided by Number of Business Establishments in Canada" between time t and t plus 6-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

X2 is "Real Interest Rate on Business Credit" times "Total Chartered Bank Business Loans Outstanding in Canada (inflation-adjusted)" all divided by "Corporate Profits for Canada" (inflation-adjusted) at time t

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X3 is the value of Y at time t

Business Bankruptcies for Canada with a 7-Quarter Horizon:

Pre Cochran-Orcutt:

b0 = +0.0030
b1 = -0.0388   t1 = -14.00
b2 = +0.0004   t2 = +2.814
b3 = -0.0015   t3 = -0.027

R-Squared = 0.883
Durbin-Watson = 0.500

Post Cochran-Orcutt:

b0 = +0.0012
b1 = -0.0401   t1 = -8.281
b2 = +0.0002   t2 = +2.316
b3 = -0.0152   t3 = -0.178

R-Squared = 0.764
Durbin-Watson = 1.830

where:

Y is <u>Change in</u> "Total Quarterly Business Bankruptcies in Canada divided by Number of Business Establishments in Canada" between time t and t plus 6-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for Canada at time t

X2 is "Real Interest Rate on Business Credit" times "Total Chartered Bank Business Loans Outstanding in Canada (inflation-adjusted)" all divided by "Corporate Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

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Business Bankruptcies for Canada with a 8-Quarter Horizon:

Pre Cochran-Orcutt: Post Cochran-Orcutt:

b0 = +0.0037   b0 = +0.0008
b1 = -0.0447   t1 = -15.29   b1 = -0.0368   t1 = -5.573
b2 = +0.0002   t2 = +1.933   b2 = +0.0001   t2 = +1.327
b3 = -0.0223   t3 = -0.387   b3 = +0.1050   t3 = +0.937

R-Squared = 0.903   R-Squared = 0.651
Durbin-Watson = 0.450   Durbin-Watson = 1.926

where:

Y is Change in "Total Quarterly Business Bankruptcies
in Canada divided by Number of Business Establishments
in Canada" between time t and t plus 8-quarters

X1 is "Unemployment Rate" (Seasonally-Adjusted) for
Canada at time t

X2 is "Real Interest Rate on Business Credit" times
"Total Chartered Bank Business Loans Outstanding in
Canada (inflation-adjusted)" all divided by "Corporate
Profits for Canada" (inflation-adjusted) at time t

X3 is the value of Y at time t

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Exhibit Two: Test Forecasts

The regression models in Exhibit One convey extensive information about the theoretical capability of the system to forecast accurately. In this exhibit we give practical demonstrations of the system's forecasting power. We do this by generating 'forecasts' at time t for changes in the bankruptcy rate between time t and t+5 quarters in cases where the latter change in bankruptcy rate already is known. We compare the 'forecast' with the actual change to get an impression of how well the system would have performed had it been used several quarters ago.

We report test forecasts for five 5-quarter periods. The choice of the five periods refects opposing factors; We want to use as many of the recent periods as possible in order to demonstrate the utility of the system. On the other hand, the further back the period for which we generate test forecasts, the fewer data points we have and the smaller the range in values taken by the dependent variable. (Recall that a regression equation is legitimate as a forecasting tool only to the extent that the actual future values taken by the variable to be forecast are within the range of the data used to generate the regression.) Thus, somewhat arbitrarily, we choose to generate test forecasts for the latter <u>five</u> 5-quarter periods for which such tests are possible; Test 1; 1990 Q2 to 1991 Q3, Test 2; 1990 Q3 to 1991 Q4, Test 3; 1990 Q4 to 1992 Q1, Test 4; 1991 Q1 to 1992 Q2, and Test 5; 1991 Q2 to 1992 Q3.

Before reporting the complete test-forecast results, we reiterate several points;

1. The premise behind test forecasts is that a 'legitimate' test forecast is one for which the forecast is generated entirely via data which would have been available at the beginning of the forecast horizon (ie. at or before the beginning of the 5-quarter period). This can be tricky. For example, to forecast the change in bankruptcy rate between 1990 Q2 and 1991 Q3, we utilize only data which was available at 1990 Q2. The values of the dependent variable used to generate the regression model are themselves 5-quarter changes with associated explanatory variables the relevant value of which is that at the <u>beginning</u> of each 5-quarter period. So, for example, the last observation eligible

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for generating a regression which is usable to 'forecast' Y for 1990 Q2 to 1991 Q3 is that with Y for 1989 Q1 to 1990 Q2 and associated X values at 1989 Q1.

2. For three reasons, the test forecasts likely are <u>less</u> accurate than what we can expect from future forecasts.

a. The test forecasts necessarily are derived from regression models which utilize fewer data points than those which currently would be used to generate forecasts.

b. The former have lower associated R-Squared values than models based upon the full, up-to-date data set.

c. The range of values for Y is much smaller for the early test forecasts, thus yielding understatement of the enormous increases in bankruptcy rates of 1990. This necessarily is far less of a problem with the complete data set.

3. For one reason, the test forecasts might be more accurate than what we can expect from future forecasts; The new bankruptcy legislation seems certain to cause "proposals" to supplant a certain proportion of <u>de jure</u> bankruptcies. Though creditors are vulnerable in each case, it may be that the timing of proposals + bankruptcies is slightly different from the pattern which bankruptcies would have followed in the absense of the new legislation.

4. The best use of the system seems to entail a focus on; a. the 5-quarter change in consumer bankruptcy rates, and b. the 5-quarter change in business bankruptcy rates. Both consumer bankruptcies and business bankruptcies have several constituent forecasts, the aggregation of which can provide a more complete impression of likely future movements in the key bankruptcy rate indicators.

We advocate this approach based on the phenomenon reflected in the data below;

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Canadian Consumer Bankruptcy Rate as a Function of:	R-Squared
Maritimes Consumer Bankruptcy Rate	0.949
Quebec Consumer Bankruptcy Rate	0.913
Ontario Consumer Bankruptcy Rate	0.928
Manitoba Consumer Bankruptcy Rate	0.961
Saskatchewan Consumer Bankruptcy Rate	0.851
Alberta Consumer Bankruptcy Rate	0.890
BC Consumer Bankruptcy Rate	0.573

Canadian Business Bankruptcy Rate as a Function of:	R-Squared
Manufacturing Bankruptcy Rate	0.925
Construction Bankruptcy Rate	0.708
Transportation etc. Bankruptcy Rate	0.930
Trade Bankruptcy Rate	0.942
Services Bankruptcy Rate	0.977

The constituent series move so closely with consumer and business bankruptcies, respectively, that there is little purpose in forecasting the former separately. The exceptions are BC consumer bankruptcies (plus, perhaps, Saskatchewan and Alberta) and Construction bankruptcies.

This leads us to aggregate the constituent consumer bankruptcy forecasts (excluding BC, and alternately including and excluding Alberta and Saskatchewan) and to aggregate the constituent business bankruptcy forecasts (excluding Construction). Recall that for both consumer and business bankruptcies, constituent forecasts include lags at 6, 7 and 8 quarters as supplements to the standard 5-quarter forecasts.

We report below the results of the test forecasts. For each of the 10 tests, we present;

a. the forecast horizon,

b. the forecast based upon taking the mean of the constituent forecasts (excluding BC in the case of consumer bankruptcies, because BC data is much less consistent with aggregate data than

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is any other constituent, either on the consumer side or on the business side),

c. the latter with relevant exclusions; Alberta and Saskatchewan excluded (and BC, which always is excluded) for consumer bankruptcies or with Construction excluded for business bankruptcies,

d. the forecast based solely upon the regression models for canadian consumer bankruptcies and for canadian business bankruptcies, respectively,

e. the latest 5-quarter change at the point of forecast. For example, the forecast for 91.2 to 92.3 is made at 91.2. The latest 5-quarter change would have been 90.1 to 91.2 which was +68.87%. This represents the forecast which would have been made if one had assumed that the recent past is the best indicator of the future.

f. the actual change in bankruptcies over the forecast horizon.

Consumer Bankruptcies for Canada (Percentage Change)

a	b	c	d	e	f
90.2 to 91.3	+32.96	+29.60	+29.15	+40.65	+62.2
90.3 to 91.4	+31.87	+28.52	+29.14	+58.24	+42.6
90.4 to 92.1	+24.23	+22.26	+21.26	+71.90	+23.7
91.1 to 92.2	+11.53	+9.84	+7.42	+79.07	+4.5
91.2 to 92.3	+2.50	+0.84	+2.14	+68.87	-5.8

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Business Bankruptcies for Canada (Percentage Change)

a	b	c	d	e	f
90.2 to 91.3	+16.48	+17.53	+18.24	+27.97	+12.6
90.3 to 91.4	+15.49	+16.10	+19.01	+40.24	+8.1
90.4 to 92.1	+7.83	+8.06	+11.82	+49.16	+1.7
91.1 to 92.2	-2.63	-1.47	-1.55	+41.72	-0.5
91.2 to 92.3	-10.05	-9.25	-9.16	+24.37	-1.3

Consider some observations regarding these test forecasts;

1. Obviously, the forecasts provide highly-useful information concerning the future course of bankruptcy rates. This is especially evident when one considers the accuracy of the forecasts in light of column e, "the latest 5-quarter change at the point of the forecast". One might have found the forecast increase of 8 or 9 percent at 1990 Q4 to have missed substantially the actual change of +1.7%. However, when reminded that the last observed change (ie. 89.3 to 90.4) would have been an increase of over 49%, the usefulness of the forecast is apparent.

In following the advice embodied in these forecasts, creditors would have contracted their loan portfolios early in 1990 (given the omission of pre-1990 test forecasts), thus avoiding the brunt of the losses-due-to-bankruptcy which occurred five-quarters later. Furthermore, they would have taken this position more extremely (and would have been rewarded commensurately) for consumer credit than for business credit. Creditors would have eased their tight credit policies around 1991 Q1 (despite the enormous increases in bankruptcy rates which they had just witnessed) and would have profited from a larger loan portfolio, accompanied by stable bankruptcy rates, than would have been the

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case had they continued the dramatic contraction in lending.[7]

Obviously, certain major loan losses occurred during this period
of stability in bankruptcy rates (eg. Olympia & York). Borrower-
Specific analysis is precisely what this system does not
contribute. The Real Economics, Inc. system deals with the
tendency of masses of borrowers to default.

2. The understatement of the increases in consumer bankruptcies
in the two initial forecasts is explainable. Increases of this
magnitude are beyond the range of Y in the data used to generate
the forecast regression. Nevertheless, these regressions did
generate forecasts substantially higher than their counterparts
for business loans (ie. about 30% versus about 17%). These two
facts combined would have led economists at 1990 Q2 to forecast
the enormous increases which actually occurred.

3. The overstatement of the decline in business bankruptcies
probably represents foreshadowing. In this regard, note that
business bankruptices from September 1992 to October 1992 (the
first month of 1992 Q4) declined 8.2%.

4. Overall, the forecasts represent about the degree of accuracy
which one would expect given the explanatory power of the models
which generated them.

But what about the Construction industry and BC consumers? Each
of these was found to be relatively independent of cross-
industry/canadian bankruptcies. This made us feel that the
aggregate forecasts should not be applied to the assessment of
credit risk either for Construction or for BC. So how does one
assess credit risk in each of these apparently distinct portions
of the economy? One answer is to forecast consumer bankruptcies

---

[7] Precisely how creditors would react to information
concerning the future pattern of bankruptcy rates is hard to say.
The knowledge and skill of creditors clearly is required in order
to utilize the output of the system optimally. Our statement of
the implications of these test forecasts reflects inexperience in
the practical business of loan portfolio management.

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in BC and business bankrutcies in the Construction industry separately from the others and to allow these forecasts to guide corresponding credit-granting policies.

In the table below, we compare the relative accuracy of forecasts of change in bankruptcy rates in the Construction industry through a separate Construction industry model versus through a cross-industry model.

a is the forecast horizon,

b is the forecast based on the cross-industry model (the same forecasts as in column b in the table above),

c is the forecast based on the Construction industry model, and

d is the actual change in Construction industry bankruptcy rates.

a	b	c	d
90.2 to 91.3	+16.48	+8.05	+23.35
90.3 to 91.4	+15.49	+10.57	+12.35
90.4 to 92.1	+7.83	+5.92	-0.1
91.1 to 92.2	-2.63	-11.87	-15.65
91.2 to 92.3	-10.05	-16.42	-27.42

The question is "would we have been better advised to forecast the change in Construction bankruptcies using the forecast across industries or the forecast specifically for the Construction industry? Two observations are salient;

1. The initial increases in bankruptcy rates are understated by much more in the Construction industry forecast than in the Cross-Industry forecast. But, consider that this Construction

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industry forecast is derived from a model with an R-Squared value of 0.262. Such a model obviously would not have been used for the purpose of forecasting. The R-Squared value for the Construction industry model has climbed steadily since then (with the addition of more data points) and now stands at 0.611, comparable with R-Squared values for other constituents.

2. The key finding here is that the Construction industry model is more successful in forecasting the great downturn in bankruptcy rate changes observed in that industry. Such a downturn did not occur across industries and was forecast to a lesser extent by the cross-industry model (especially when one considers that the Construction forecast is one-sixth of the Cross-Industry forecast).

The recently improved explanatory power of the Construction industry model as well as some demonstrated capacity to provide extra forecasting power for more recent data, cause us to recommend that Construction industry forecasts be made via the industry-specific regression model.

The case of BC consumer bankruptcies is more troublesome. The historical models used for test forecasts have inadequate R-Squared values to permit comparative test forecasts of the sort that was done above for the Construction Industry. The current model for BC does, however, have an R-Squared value comparable with that of other regional models. This, in combination with the low historical correlation between canadian consumer bankruptcies and BC consumer bankruptcies, might lead one to make the same recommendation for BC as we made for the Construction industry. There is one complication though; The low correlation between Canada and BC, as well as the low explanatory power of early BC models may have the same cause. The increased explanatory power of BC models may have been accompanied by stronger relationship between Canada and BC. One can know for certain if this is true only by observing data on bankruptcy rates in the two regions which will become available in future years. This possibility leaves some uncertainty as to the advisability of generating separate forecasts for BC.

Obviously, an analogous concern could be raised in the case of the Construction industry. We feel more confident in our hypothesis that the Construction industry is truly separate

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because bankers and economists have known for years about its quirkiness. It is no surprise that the industry's behaviour in this instance is non-conforming.

The Complete Set of Test Forecasts

Each of the columns labeled 'b' in the tables above represent aggregations of the constituent forecasts for consumer bankruptcies and for business bankruptcies, respectively. The reported forecast simply is the mean for each of the relevant sets of constituent forecasts. Below, we report the complete set of constituent forecasts. First, though, consider some details concerning calculations of the forecasts themselves;

1. All forecasts are rendered "percentage-change" by dividing the 5-quarter change by the initial bankruptcy rate and then multiplying by 100.

2. The 6, 7 and 8-quarter forecasts are rendered comparable with the others by subtracting the 'excess' change in the bankruptcy rate. For example, the raw forecast for the change in consumer bankruptcy rate for 1990.3 to 1991.4 from the "lag-7" model is +1.1403. But this is the 7-quarter change from 1990.1 to 1991.4; We want the 5-quarter change from the time 2 quarters after the point of this 7-quarter forecast. We know at the time of the forecast that the actual change from 1990.1 to 1990.3 is +0.4920. Thus, the relevant forecast is 1.1403-0.4920 = 0.6483, which then is found to represent a change of +19.98%

Change in Consumer Bankruptcy Rate -- Test #1: 1990 Q2 to 1991 Q3

Forecast Derived from Consumer Bankruptcy Data for:	Forecast;
Canada	+29.15%

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Maritimes	+29.09%
Quebec	+18.21%
Ontario	+35.62%
Manitoba	+49.41%
Saskatchewan	+43.35%
Alberta	+37.50%
BC	R-Squared = 0.259 is too low to use for the purpose of forecasting
Canada Lag-6	+22.81%
Canada Lag-7	+20.05%
Canada Lag-8	+44.49%

Change in Consumer Bankruptcy Rate -- Test #2: 1990 Q3 to 1991 Q4

<u>Forecast Derived from Consumer Bankruptcy Data for</u>:	<u>Forecast</u>:
Canada	+29.14%
Maritimes	+33.06%
Quebec	+15.96%
Ontario	+37.61%
Manitoba	+48.09%

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Saskatchewan	+44.41%
Alberta	+38.23%
BC	R-Squared = 0.297 is too low to use for the purpose of forecasting
Canada Lag-6	+27.08%
Canada Lag-7	+14.87%
Canada Lag-8	+32.29%

Change in Consumer Bankruptcy Rate -- Test #3: 1990 Q4 to 1992 Q1

Forecast Derived from Consumer Bankruptcy Data for:	Forecast:
Canada	+21.26%
Maritimes	+28.41%
Quebec	+9.58 %
Ontario	+26.42%
Manitoba	+34.32%
Saskatchewan	+36.61%
Alberta	+27.58%
BC	R-Squared = 0.352 is too low to use for the purpose of forecasting
Canada Lag-6	+18.62%
Canada Lag-7	+18.01%

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Canada Lag-8   +21.49%

Change in Consumer Bankruptcy Rate -- Test #4: 1991 Q1 to 1992 Q2

Forecast Derived from Consumer Bankruptcy Data for:	Forecast:
Canada	+7.42%
Maritimes	+12.66%
Quebec	+4.60%
Ontario	+2.73%
Manitoba	+9.27%
Saskatchewan	+21.06%
Alberta	+15.50%
BC	R-Squared = 0.453 is too low to use for the purpose of forecasting
Canada Lag-6	+9.87%
Canada Lag-7	+10.52%
Canada Lag-8	+21.74%

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Change in Consumer Bankruptcy Rate -- Test #5: 1991 Q2 to 1992 Q3

Forecast Derived from Consumer Bankruptcy Data for:	Forecast:
Canada	+2.14%
Maritimes	+2.91%
Quebec	+4.5%
Ontario	-5.51%
Manitoba	-0.7%
Saskatchewan	+10.10%
Alberta	+8.23%
BC	R-Squared = 0.556 probably is adequate for the purpose of forecasting, but for consistency we continue to exclude the BC forecasts from consideration.
Canada Lag-6	-5.31%
Canada Lag-7	-1.89%
Canada Lag-8	+10.59%

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Change in Business Bankruptcy Rate -- Test #1: 1990 Q2 to 1991 Q3

Forecast Derived from Business Bankruptcy Data for:	Forecast:
Across Industries	+18.24%
Manufacturing	+8.91%
Construction	+ 8.05%
Transportation & Communication	+18.41%
Trade	+20.33%
Services	+16.99%
Across Industries Lag-6	+12.92%
Across Industries Lag-7	+29.04%
Across Industries Lag-8	+15.47%

Change in Business Bankruptcy Rate -- Test #2: 1990 Q3 to 1991 Q4

Forecast Derived from Business Bankruptcy Data for:	Forecast:
Across Industries	+19.01%
Manufacturing	+20.99%
Construction	+10.57%

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Transportation & Communication	+5.65%
Trade	+19.54%
Services	+20.35%
Across Industries Lag-6	+14.16%
Across Industries Lag-7	+19.98%
Across Industries Lag-8	+9.19%

Change in Business Bankruptcy Rate -- Test #3: 1990 Q4 to 1992 Q1

Forecast Derived from Business Bankruptcy Data for:	Forecast:
Across Industries	+11.82%
Manufacturing	+14.17%
Construction	+5.92%
Transportation & Communication	-15.17%
Trade	+8.93%
Services	+13.00%
Across Industries Lag-6	+10.88%
Across Industries Lag-7	+19.51%
Across Industries Lag-8	+1.48%

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Change in Business Bankruptcy Rate -- Test #4: 1991 Q1 to 1992 Q2

Forecast Derived from Business Bankruptcy Data for:	Forecast;
Across Industries	-1.55%
Manufacturing	-5.10%
Construction	-11.87%
Transportation & Communication	-18.50%
Trade	-0.1%
Services	0.0%
Across Industries Lag-6	+3.37%
Across Industries Lag-7	+8.22%
Across Industries Lag-8	+1.91%

Change in Business Bankruptcy Rate -- Test #5: 1991 Q2 to 1992 Q3

Forecast Derived from Business Bankruptcy Data for:	Forecast;
Across Industries	-9.16%
Manufacturing	-0.02%

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Construction	-16.42%
Transportation & Communication	-25.58%
Trade	-9.68%
Services	-10.63%
Across Industries Lag-6	-6.52%
Across Industries Lag-7	-12.27%
Across Industries Lag-8	-0.2%

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Appendix: Claims -- Specific Elements of the System for which Patent Protection is Sought

We have outlined an extremely detailed version of our system for two reasons; a. So that its usefulness is demonstrated, and b. So that there is no doubt that we have disclosed sufficient detail to enable one trained in this area to use the system profitably. Such disclosure, we understand, is provided in exchange for patent protection.

Our Patent "Claims" are, however, more general than the version of the system outlined in this document.

Claims;

1. the use of regression models to forecast bankruptcy rates across a region, industry or entire economy as a mechanism through which a creditor can formulate its aggregate loan-granting strategy

2. Two techniques are salient in developing the models in claim 1.: use of lengthy forecast horizons, and, assessment of the credit risk in a region, industry or entire economy approximately in the same way as creditors traditionally have evaluated individual borrowers; Specifically, a region, industry or entire economy can be said to possess an "economic condition", a level of "debt burden", and a "credit history" (as well as levels of "accumulated wealth" and "liquidity"). Each of these concepts can be operationalized via a specific explanatory variable.

3. Forecasts for respective regions/industries can be made using analogous versions of the same set of explanatory variables. For example, "Debt Burden" for British Columbia can be used to forecast British Columbia Consumer Bankruptcies, while "Debt Burden" for Canada can be used to forecast Consumer Bankruptcies for Canada.

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4. One may generate forecasts for each region/industry separately in order to assess the credit risk embodied in that region/industry, or one may use the set of such region/industry forecasts in order to generate only two broad forecasts; one for consumer loans over-all and one for business loans over-all.

SUBSTITUTE

REMPLACEMENT

SECTION is not Present

Cette Section est Absente

DERWENT-ACC-NO: 1994-264584

DERWENT-WEEK: 199433

TITLE: Credit risk assessment system - generates forecasts of
                  bankruptcy rates for region or industry using regression
                  models

INVENTOR: WILLIS, M

PATENT-ASSIGNEE: WILLIS M[WILLI]

PRIORITY-DATA: 1992CA-2086269 (December 24, 1992)

PATENT-FAMILY:

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ABSTRACTED-PUB-NO: CA 2086269A

BASIC-ABSTRACT:

The system uses regression models,two techniques of which are salient in
developing the models: the use of lengthy forecast horizons, and, assessment of
the credit risk in a region, industry or entire economy approximately in the
same way as creditors traditionally have evaluated individual borrowers.
Specifically, a region, industry or entire economy can be the to possess an
"economic condition", a level of "debt burden", and a "credit history"
(as well as levels of "accumulated wealth" and "liquidity"). Each of these
concepts can be operationalised via a specific explanatory variable.

Forecasts for respective regions/industries can be made using analogous
versions of the same set of explanatory variables. For example, "Debt
Burden" for British Columbia can be used to forecast British Columbia Consumer
Bankruptcies, while "Debt Burden" for Canada can be used to forecast Consumer
Bankruptcies for Canada.

USE/ADVANTAGE - For gauging likelihood of loan default across entire economy or
portion of economy e.g. region or industry. For forecasting bankruptcy rates

upto 5 or more quarters ina advance. Allows creditor to make profitable adjustments in its loan granting, loan monitoring and loan collection practices.

CHOSEN-DRAWING: Dwg.0/0

TITLE-TERMS: CREDIT RISK ASSESS SYSTEM GENERATE FORECAST RATE REGION INDUSTRIAL
        REGRESSION MODEL

DERWENT-CLASS: T01

EPI-CODES: T01-J05A1;

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